

# Claims

[c1] We claim:

1. A method for diagnosing failing scan chains, the method comprising the steps of:  
identifying logic paths from a target scan chain to at least one observation scan chain until a pre-specified selection criterion is achieved;  
activating the identified logic paths so as to capture the contents of associated target latches in the target scan chain into observation latches in at least one observation scan chain; and  
analyzing the contents of the observation latches to determine defect ranges in the target scan chain.

[c2] 2. The method of claim 1, wherein at least one latch of the target scan chain is not observed from any other scan chain.

[c3] 3. The method of claim 1, wherein the step of identifying logic paths from the target scan chain comprises the step of identifying logic paths from the target scan chain to at least two observation scan chains.

[c4] 4. The method of claim 1, wherein the identified logic

paths are identified in order of increasing logic path complexity.

- [c5] 5. The method of claim 1, wherein the step of identifying the logic paths from the target scan chain to the at least one observation scan chain until the pre-specified selection criterion is achieved comprises the step of identifying simple logic paths from the target scan chain to the at least one other observation scan chain, wherein simple logic paths are defined as logic paths with no side inputs.
- [c6] 6. The method of claim 5, wherein the step of identifying the logic paths from the target scan chain to the at least one observation scan chain until the pre-specified selection criterion is achieved further comprises the step of identifying complex logic paths from the target scan chain to the at least one observation scan chain, if the pre-specified selection criterion is not achieved with the identified simple logic paths.
- [c7] 7. The method of claim 1, wherein the pre-specified selection criterion is specified in terms of the maximum value of the largest distance in latches between two adjacent target latches in the target scan chain.
- [c8] 8. The method of claim 1, wherein the step of analyzing

the contents of the observation latches to determine defect ranges in the target scan chain comprises the steps of:

measuring the contents of the observation latches; and  
comparing only the contents of the observation latches to expected data.

- [c9] 9. A method of constructing scan chains to enable diagnosing failing scan chains, the method comprising the steps of:
- identifying simple logic paths from first target latches in a target scan chain to at least one other observation scan chain; and  
optimizing the locations of the first target latches in the target scan chain.
- [c10] 10. The method of claim 9, wherein the step of optimizing the locations of the first target latches in the target scan chain comprises reordering the first target latches in the target scan chain such that the largest distance in terms of latches between two adjacent target latches in the target scan chain is reduced.
- [c11] 11. The method of claim 9, wherein the step of optimizing the locations of the first target latches in the target scan chain comprises moving at least one of the first target latches to a location in another scan chain.

- [c12] 12. The method of claim 9, further comprising the steps of:  
identifying complex logic paths from second target latches in the target scan chain to at least one other observation scan chain, if a pre-specified selection criterion has not been achieved with the first target latches after location optimization; and  
optimizing the locations of the first and second target latches in the target scan chain.
- [c13] 13. The method of claim 12, wherein the step of optimizing the locations of the first and second target latches in the target scan chain comprises the step of re-ordering the first and second target latches in the target scan chain such that the largest distance in terms of latches between two adjacent target latches in the target scan chain is reduced.
- [c14] 14. The method of claim 12, wherein the step of optimizing the locations of first and second target latches in the target scan chain comprises the step of reordering the first and second target latches in the target scan chain such that the largest distance in terms of latches between two adjacent target latches in the target scan chain is minimized.

- [c15] 15. The method of claim 12, further comprising the steps of:  
adding at least a third target latch into the target scan chain; and  
adding a logic path connecting the third target latch to an existing observation latch in another scan chain.
- [c16] 16. The method of claim 12, further comprising the steps of:  
identify an existing latch in the target latch as a third target latch; and  
adding at least an observation latch into another scan chain; and  
adding a logic path from the third target latch to the added observation latch.
- [c17] 17. The method of claim 12, further comprising the steps of:  
adding at least one third target latch into the target scan chain;  
adding at least an observation latch in another scan chain; and  
adding a logic path from the third target latch to the added observation latch.
- [c18] 18. The method of claim 17, further comprising the step of optimizing the locations of the observation latches

associated with the at least one third target latch.

- [c19] 19. The method of claim 12, wherein the step of optimizing the locations of the first and second target latches in the target scan chain comprises the step of, if any complex logic path is identified, moving at least a target latch associated with the side input of the complex logic path to a location in another scan chain other than the target scan chain.
- [c20] 20. The method of claim 12, wherein the step of optimizing the locations of the first and second target latches in the target scan chain comprises the step of moving at least one latch of the first and second target latches from the target scan chain to another scan chain.
- [c21] 21. A method of constructing scan chains to enable diagnosing failing scan chains, the method comprising the steps of:  
identifying logic paths from target latches in a target scan chain to observation latches in at least one other observation scan chain; and  
optimizing the locations of the observation latches within the other scan chains.
- [c22] 22. The method of claim 21, wherein the step of optimizing the locations of the observation latches in the at

least one other scan chain comprises locating the observation latches associated with a target scan chain within a subset of the other scan chains.

- [c23] 23. The method of claim 21, wherein the step of optimizing the locations of the observation latches in the at least one other scan chain comprises the step of reordering the observation latches in the at least one other scan chain such that the largest distance in terms of latches between two adjacent observation latches is reduced.
- [c24] 24. The method of claim 21, wherein the step of optimizing the locations of the observation latches in the other scan chains comprises the step of reordering the observation latches in the other scan chains such that the observation latches are located close to the scanout of the scan chain.
- [c25] 25. A method for diagnosing failing scan chains, the method comprising the steps of:  
identifying at least one target latch in a target scan chain;  
identifying at least one logic path electrically coupled to the at least one target latch; and  
identifying at least one observation latch electrically coupled to the at least one logic path.

- [c26] 26. The method of claim 25, further comprising the step of running test patterns against the target scan chain.
- [c27] 27. The method of claim 26, further comprising the step of activating the at least one identified logic path so as to capture the contents of the at least one target latch in the target scan chain into the at least one observation latch.
- [c28] 28. The method of claim 27, further comprising the step of analyzing the contents of the at least one observation latch to determine defect ranges in the target scan chain.
- [c29] 29. The method of claim 25, wherein the step of identifying the at least one observation latch electrically coupled to the at least one logic path comprises the step of identifying at least two observation latches being on at least two different scan chains and electrically coupled to the at least one logic path.
- [c30] 30. The method of claim 25, further comprising the steps of:  
adding at least one target latch into the target scan chain; and  
adding at least one logic path connecting the at least one target latch to at least one existing observation latch in at least one other scan chain.



[c31] 31. The method of claim 25, further comprising the steps of:  
constructing a correspondence between the at least one target latch, a target latch state, the at least one observation latch, and an expected observation latch state;  
and  
compiling the correspondence into a lookup table.